



# VALUE-DRIVEN

**“CalCapture”  
Elk Hills CO<sub>2</sub> Capture with EOR  
and Permanent Sequestration**

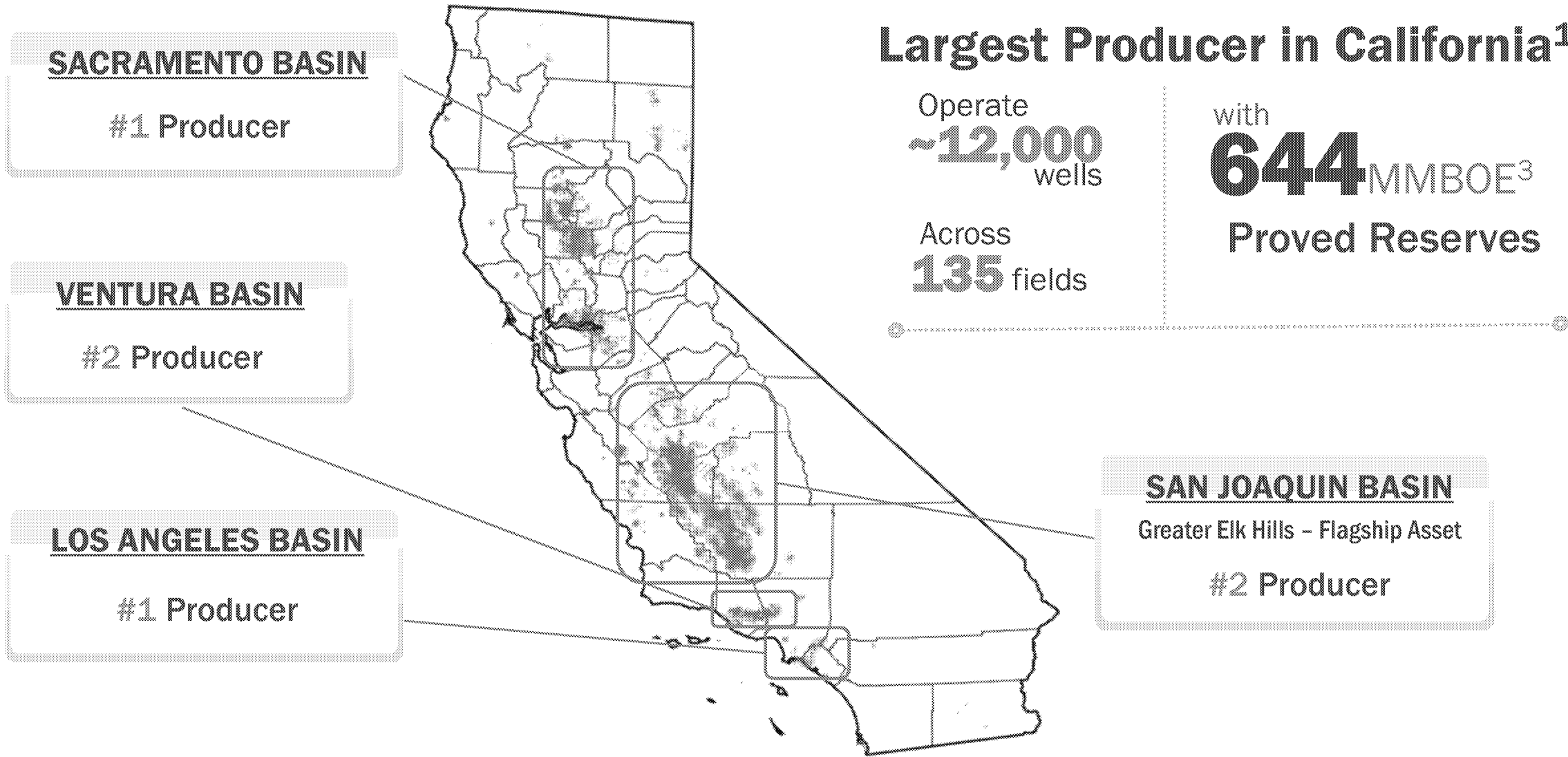
Ken Haney  
EOR and CCS Manager  
August 24, 2020

# Meeting Tentative Agenda

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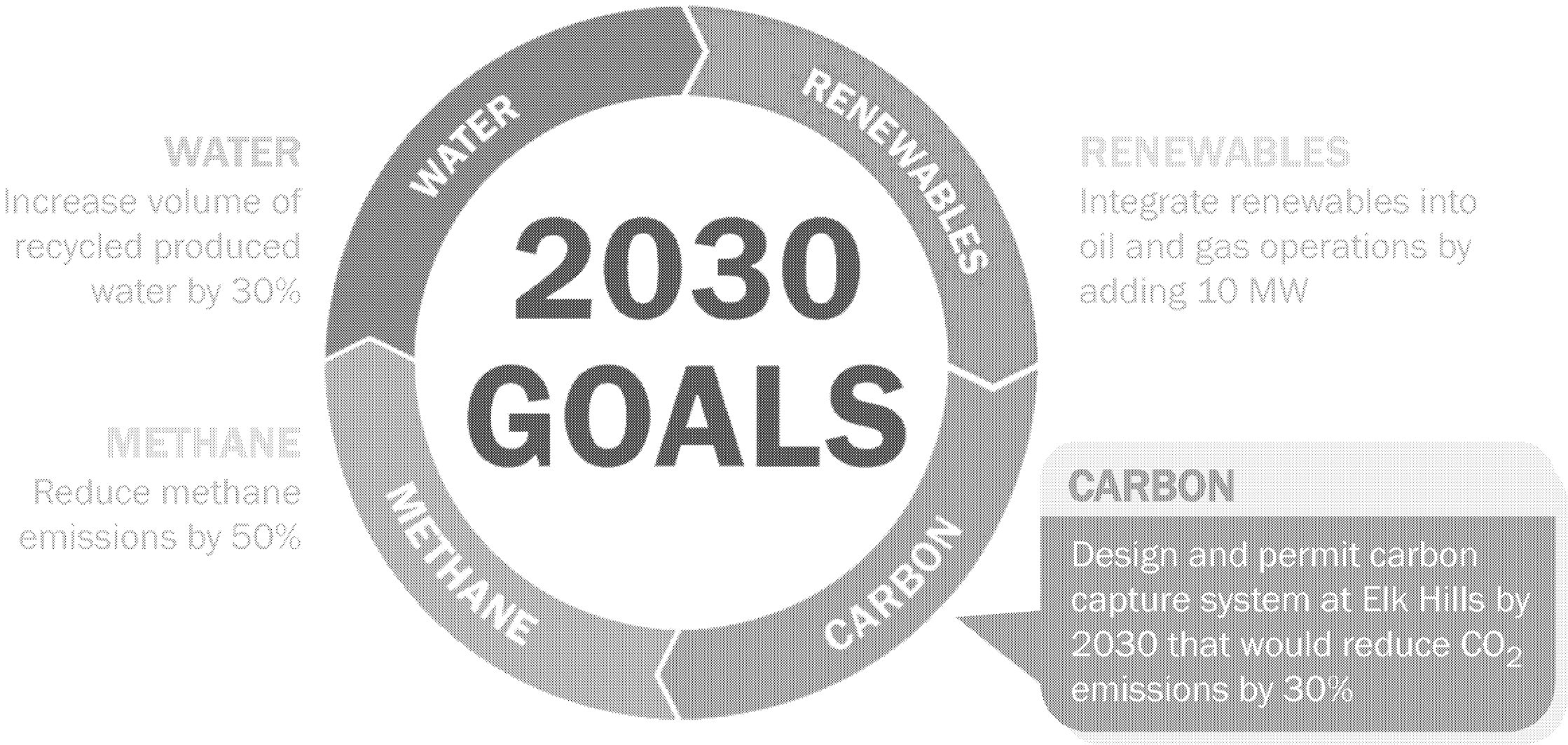
- Introductions
- CalCapture Overview
- California Regulatory Pathway
- Class VI
  - EPA Observed Challenges/Concerns/Questions
  - CRC Questions/Discussion
    - Class VI permit timing
    - Combination with Class II
    - Utilization of Class II injectors
    - Idle well requirements
    - State Primacy (CA ?, Wy timing ?)
    - Key contacts
    - Other
- Follow-up

# California Resources Corporation (CRC) is the Largest Operator in California



<sup>1</sup> Based on gross production YE19.      <sup>3</sup> Proved reserves at SEC19 pricing of \$63.15 Brent / \$2.58 NYMEX

# Our Sustainability Goals Align with the California Strategy

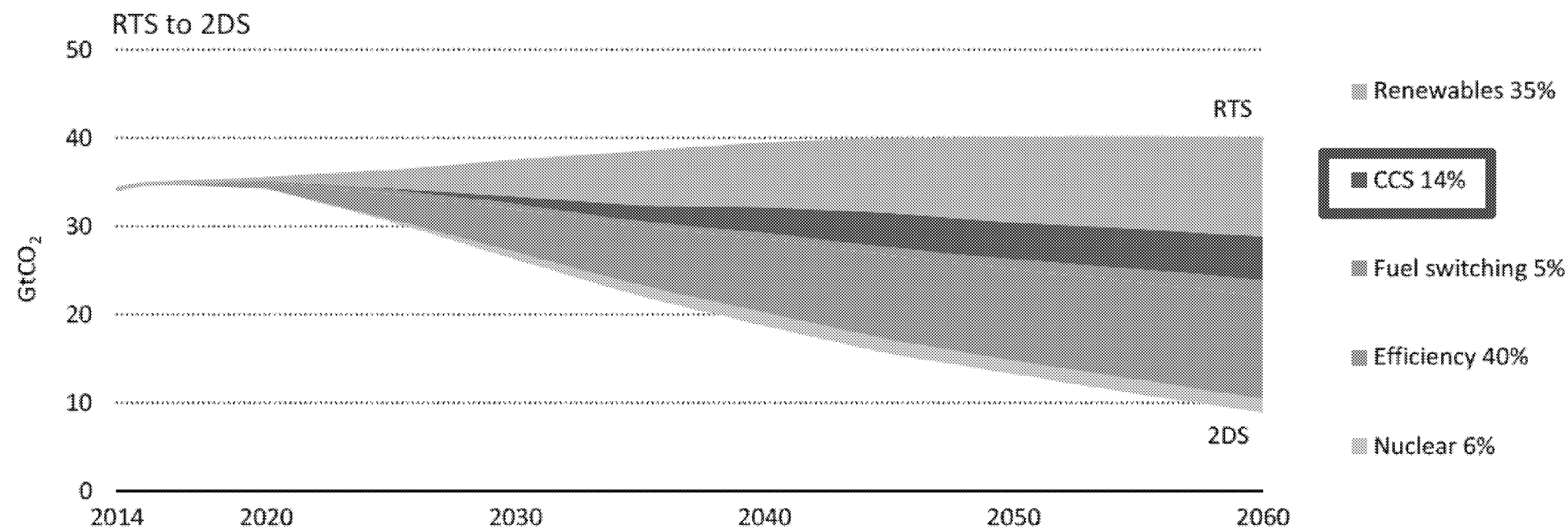


Note: CRC 2030 Sustainability Goals are subject to liquidity, securing funding and permits

# Carbon Capture and Sequestration (CCS) Is an Important Contributor

Figure

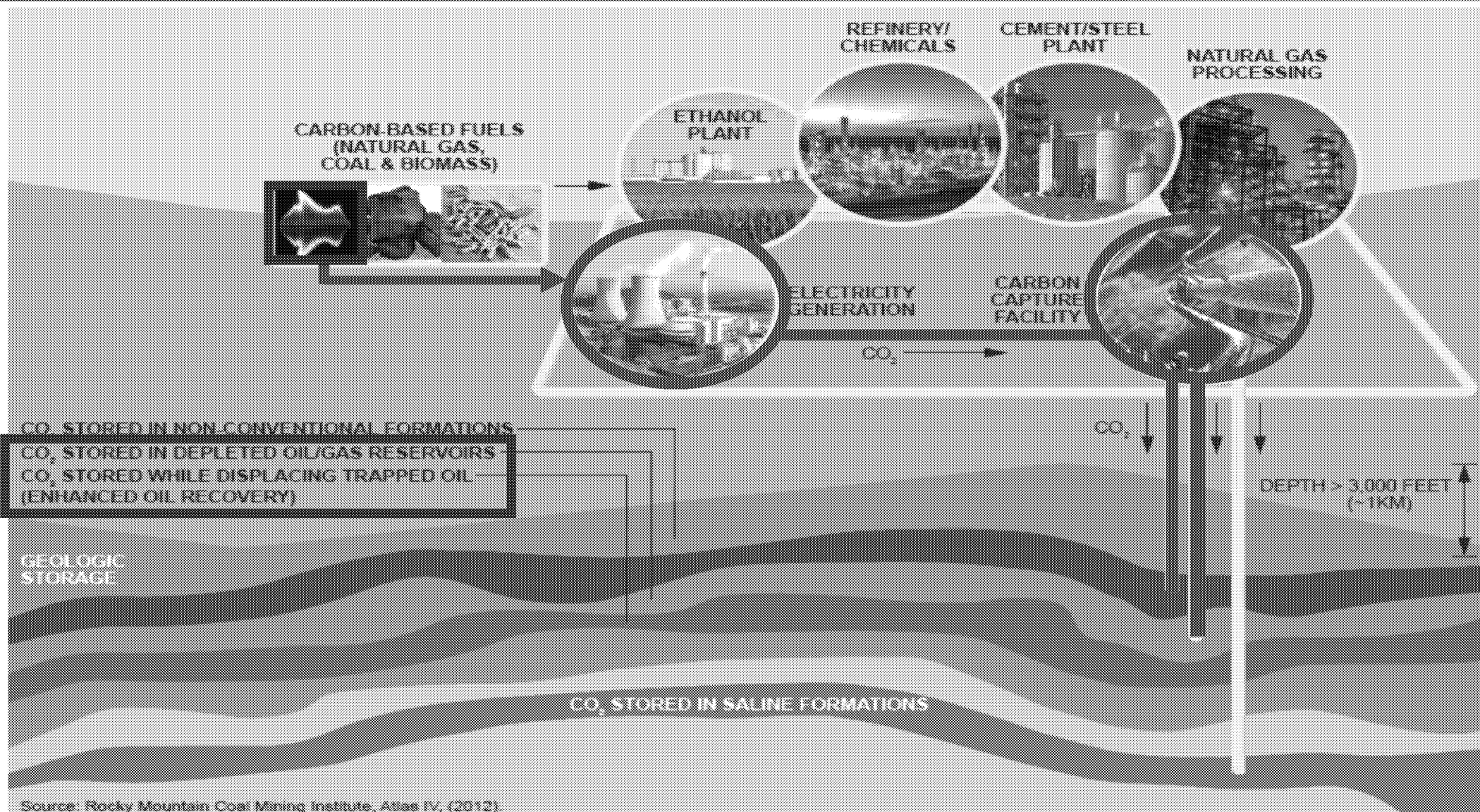
1.6. Global CO<sub>2</sub> emissions reductions by technology area: RTS to 2DS



Note: CO<sub>2</sub> emissions include both energy-related CO<sub>2</sub> emissions and emissions from industrial processes.



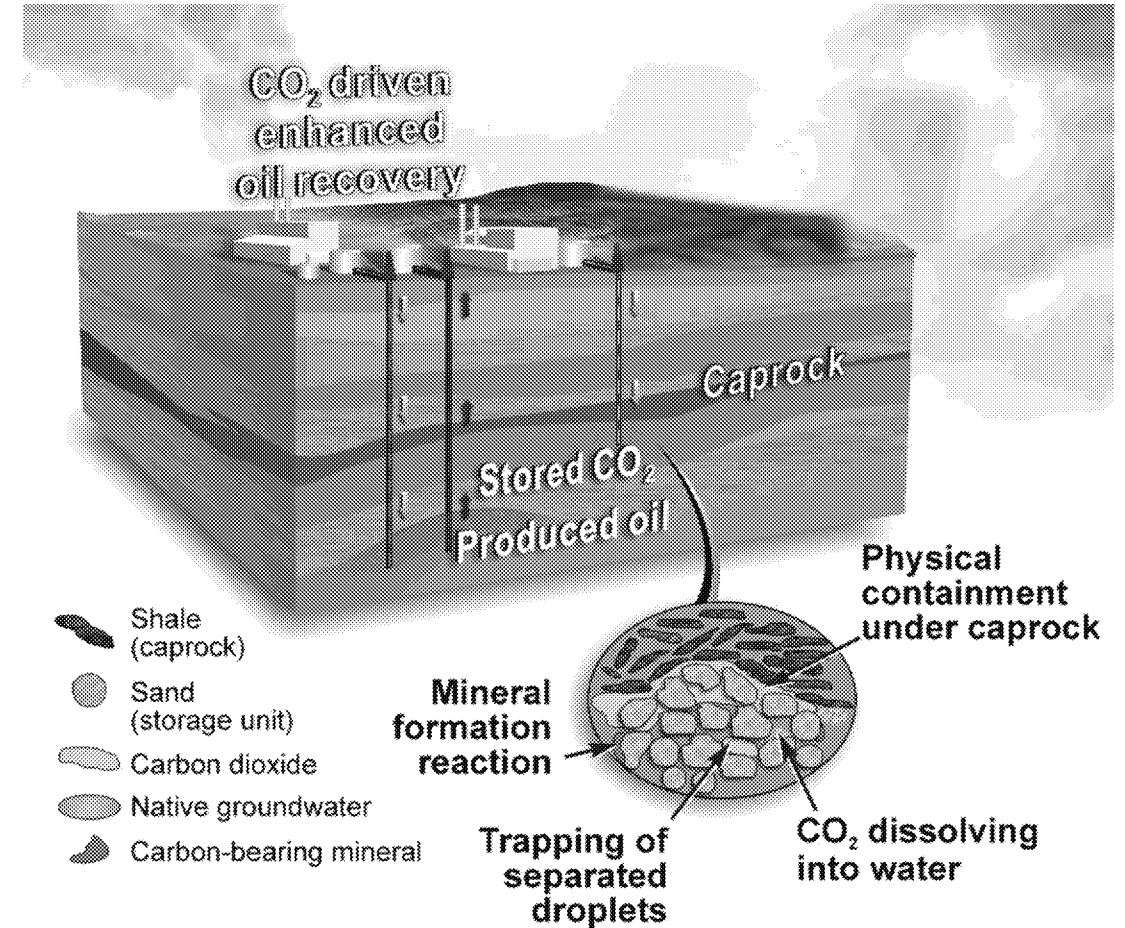
# The CO<sub>2</sub> Supply Chain for Conventional Carbon Capture and Storage



Source: Rocky Mountain Coal Mining Institute, Atlas IV, (2012).

# A “Real” Solution: CalCapture Combines CCS with EOR

- ✓ Significant immediate emissions reductions
- ✓ Clean, safe and affordable energy for California
- ✓ Prolific economic impact on local, state and national economies
- ✓ NGCC power plant capture technology development

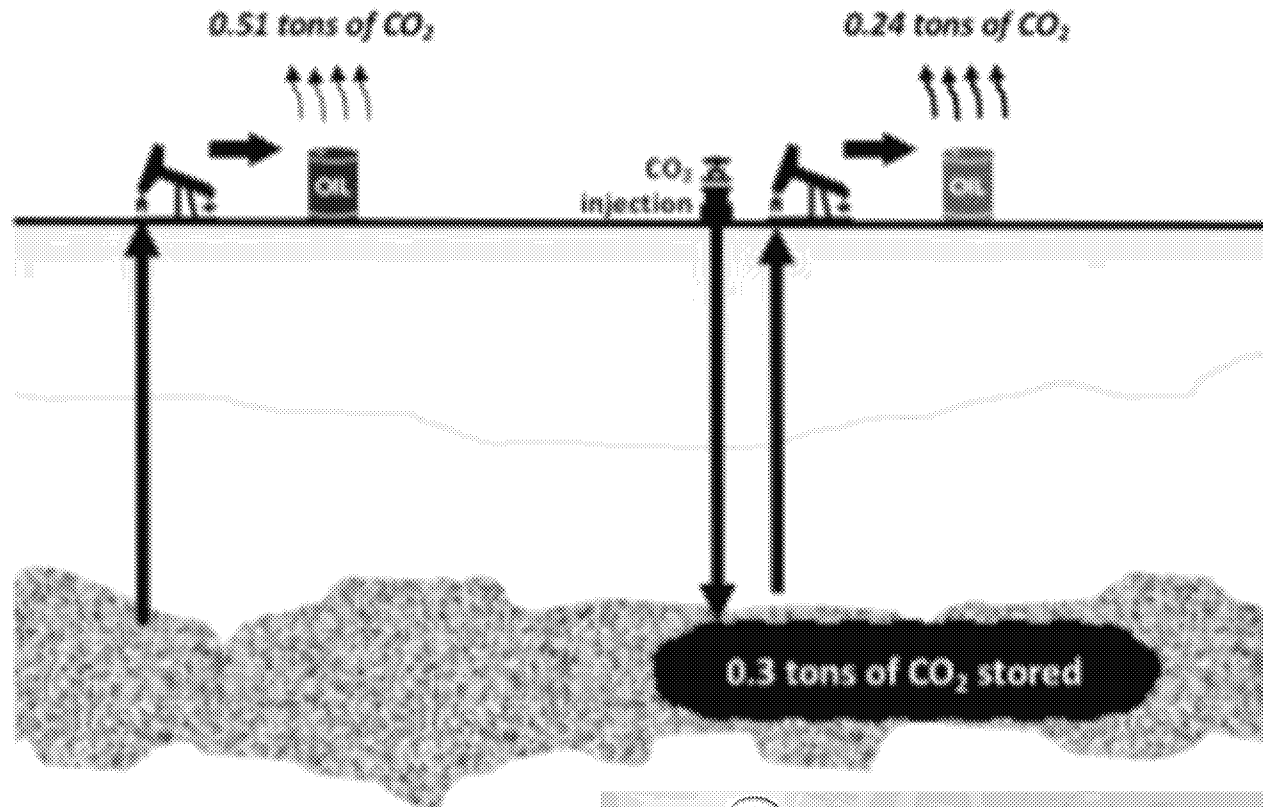


Source: California Air Resources Board

# CCS with EOR Cuts Lifecycle Oil Emissions by 40% - 50%

**Conventional Oil Production**  
emits 0.51 tons of CO<sub>2</sub> per barrel

**Enhanced Oil Recovery**  
emits 0.54 tons per barrel. But, it also  
stores 0.30 metric tons of CO<sub>2</sub>  
underground. Thus, net emissions are 0.24  
tons per barrel.



## Phase 1 (10-15 years)

- Captures 15-20 million metric tons of CO<sub>2</sub>
- ~250,000 vehicles/year

## Additional Targets

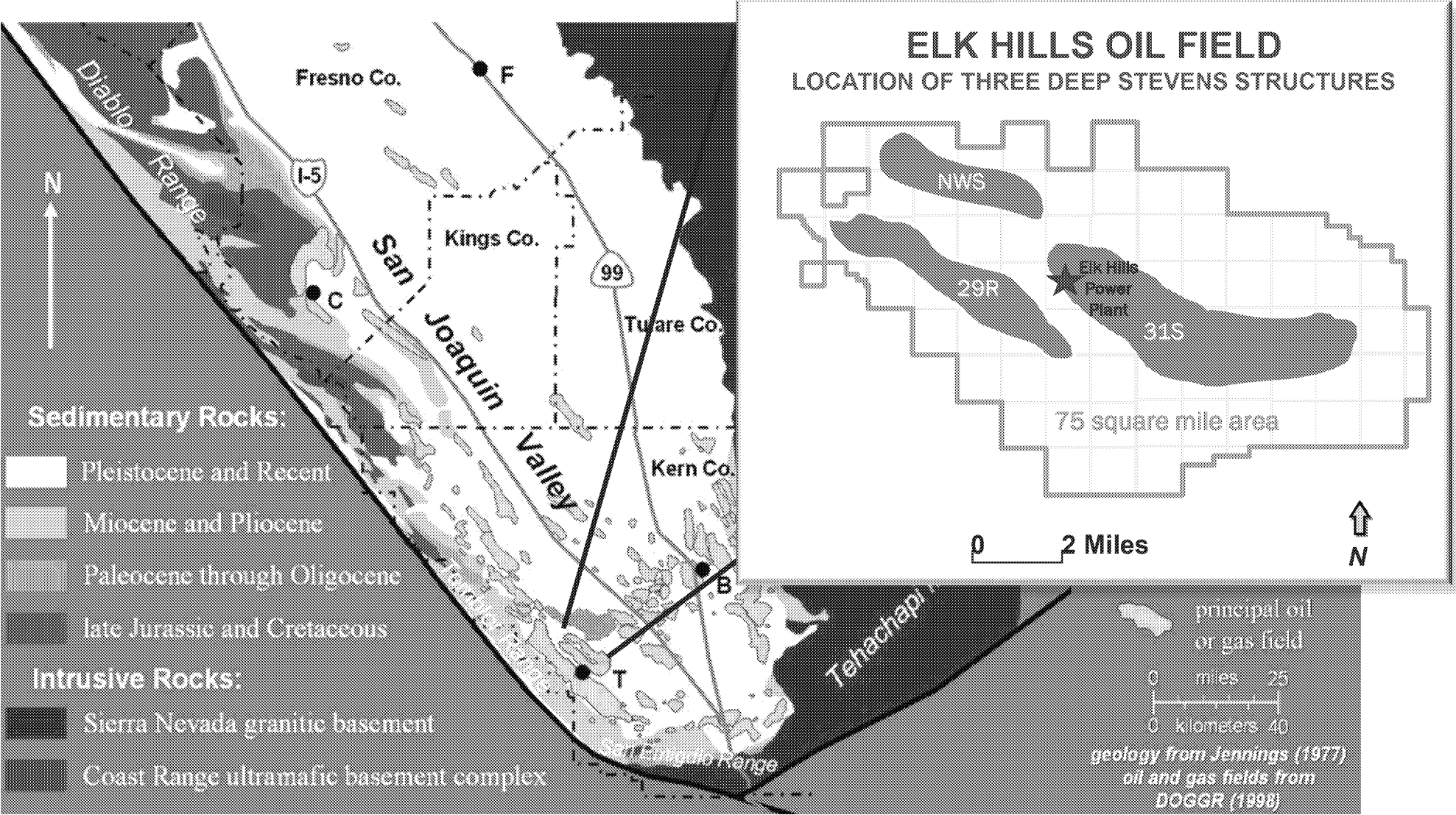
- Up to 20 million metric tons

CLEAN AIR  
TASK FORCE

The Emission Reduction Benefits of Carbon  
Capture Utilization and Storage using CO<sub>2</sub>  
Enhanced Oil Recovery



# CRC's Elk Hills Field Is Primed to Lead California into CCS



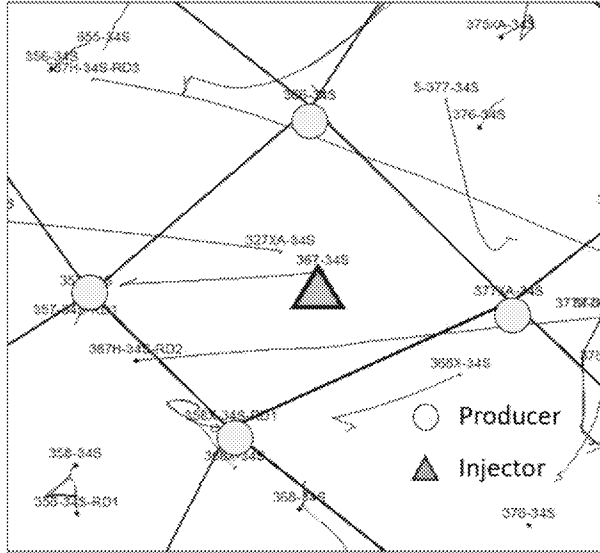
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## CO<sub>2</sub> Capture



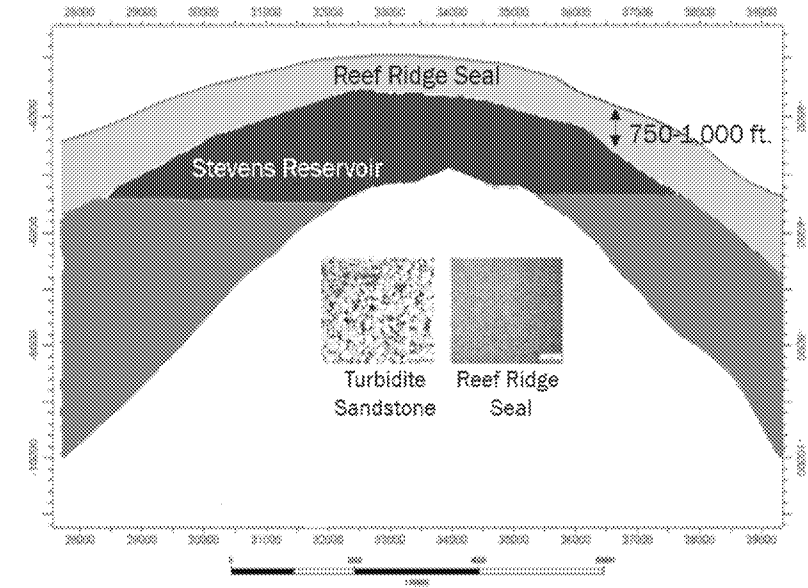
- ✓ **Technical Review**
- **FEED Studies**
- **Funding**

## Enhanced Oil Recovery



- ✓ Miscible field pilots
- Field Design Updates
  - Surface Facilities
  - Reservoir Simulation

## Sequestration & Regulatory



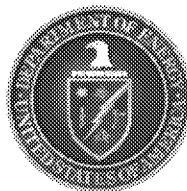
- ✓ Geologic Appraisal
- ✓ Regulatory Pathway
- Permit Applications

# 1st FEED Study will Complete 11/2020

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## US Department of Energy

- **CRC Awarded Funding for Carbon Capture FEED**
  - \$7mm federal award
- **Partners**
  - FLUOR – Amine Absorption Technology/Construction
  - Electric Power Research Institute (EPRI) - Lead Applicant and Project Manager

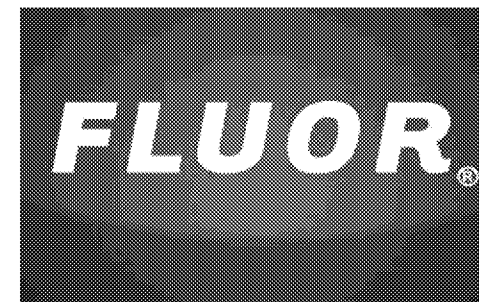


Department of Energy (DOE)  
Office of Fossil Energy (FE)

**FRONT-END ENGINEERING DESIGN STUDIES FOR CARBON  
CAPTURE SYSTEMS ON COAL AND NATURAL GAS POWER  
PLANTS**

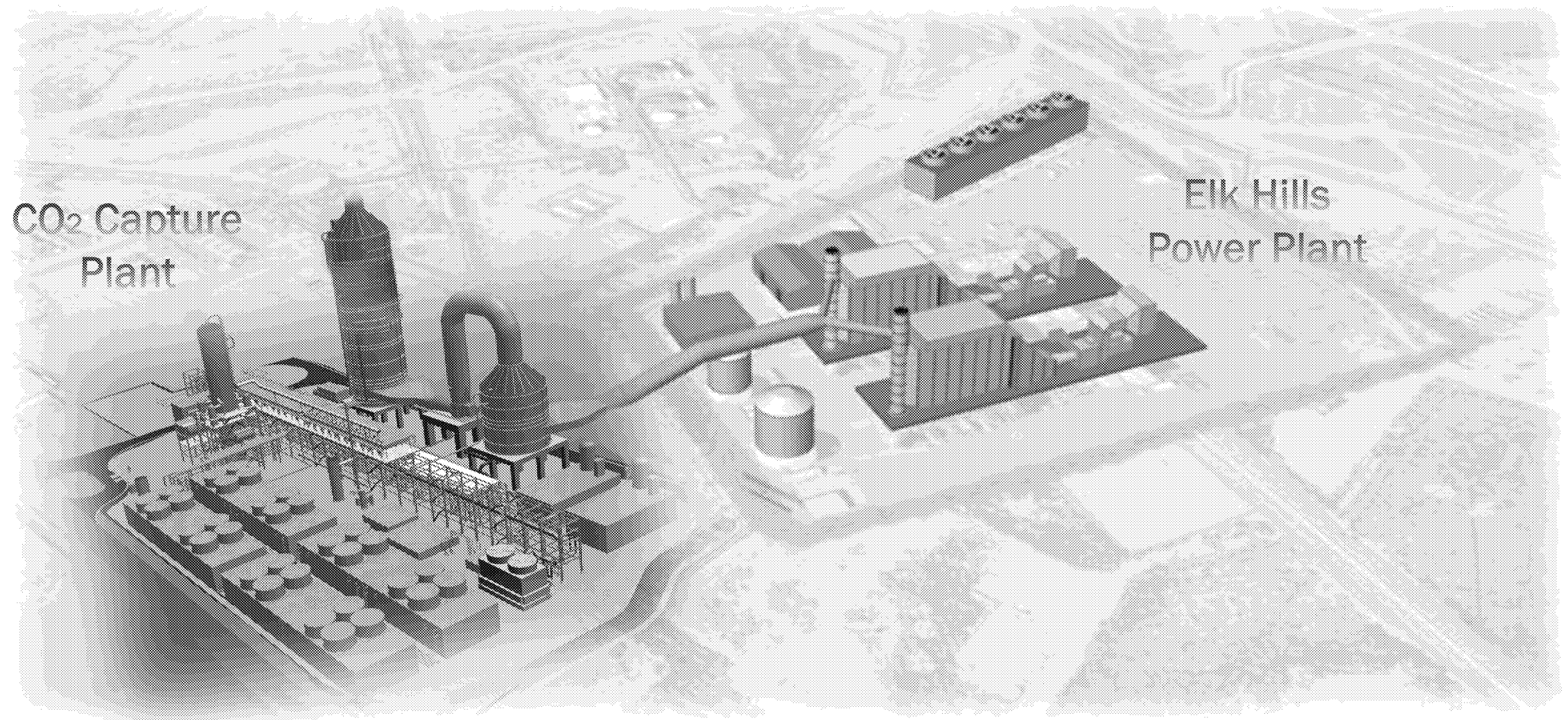
Funding Opportunity Announcement (FOA) Number: DE-FOA-0002058  
FOA Type: Initial FOA Release<sup>1</sup>  
CFDA Number: 81.089 – Fossil Energy Research and Development

**EPRI**  
ELECTRIC POWER  
RESEARCH INSTITUTE

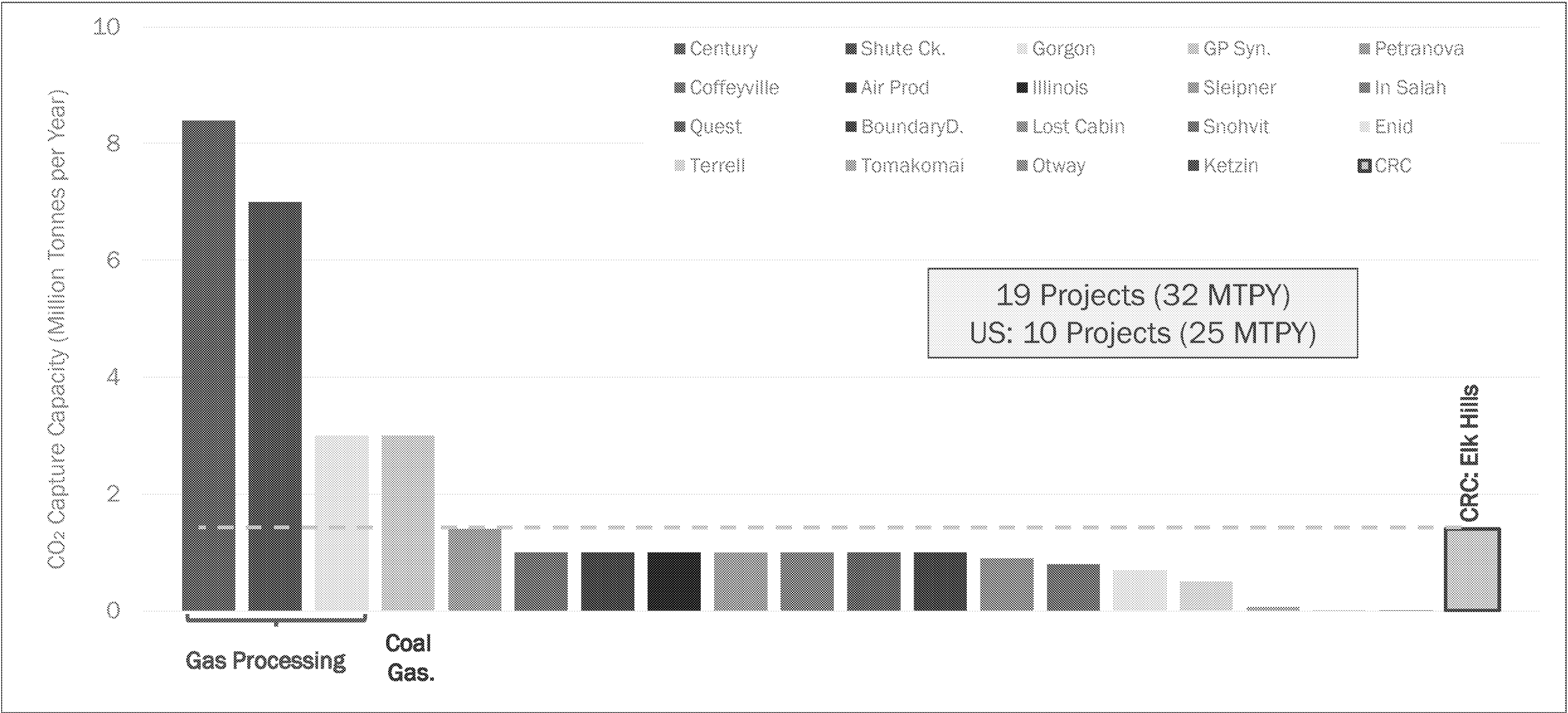


# Current Capture Facility Layout

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# 5<sup>th</sup> Largest CCS Project World-Wide, 1<sup>st</sup> for NGCC Power Plant

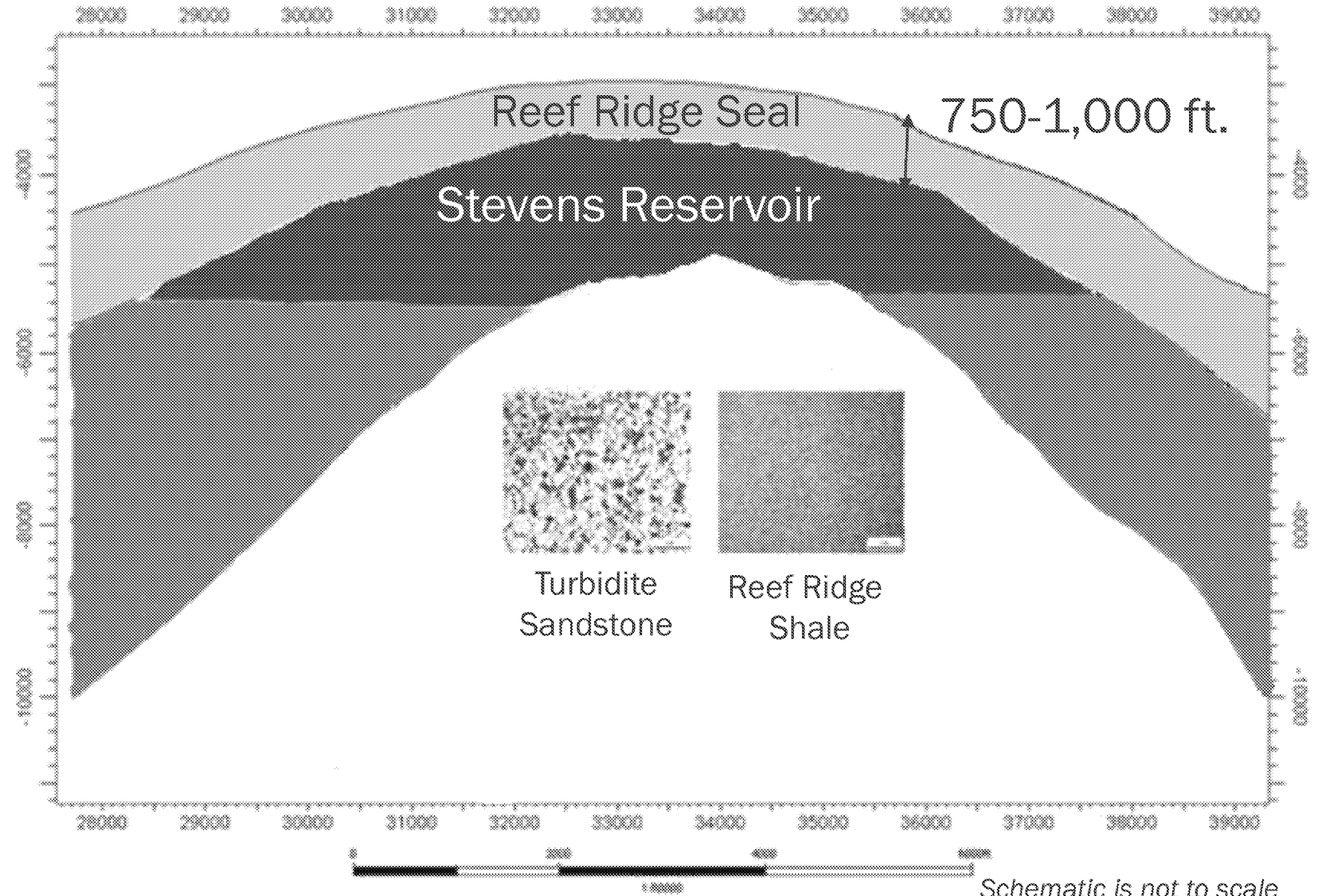




# Elk Hills Stevens Reservoirs are Ideal for EOR and CO<sub>2</sub> Sequestration

Elk Hills Field one of the most suitable locations for the extraction of hydrocarbons and the sequestering of CO<sub>2</sub> in North America."

Appendix F. URS Report on CO<sub>2</sub> Sequestration for California Energy Commission. 2010



# Advantage CalCapture

## A Fully Integrated Project

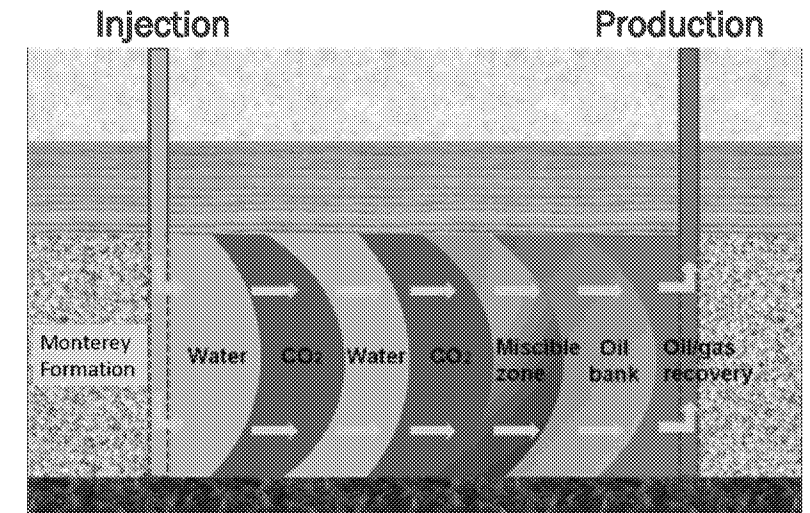
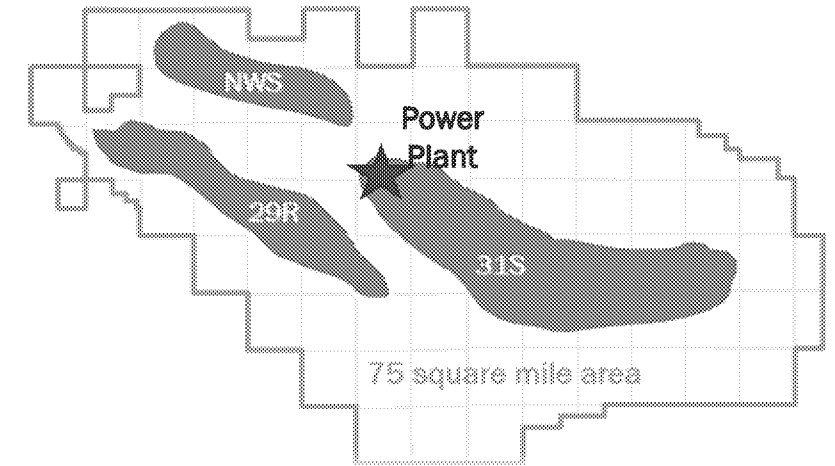
- ✓ CO<sub>2</sub> source on location with reservoirs
- ✓ CRC owns infrastructure/surface/pore space
- ✓ EOR and Pure Storage Alternatives

## Commercial Readiness

- ✓ Uncertainty ranges understood
- ✓ Economics supported by carbon credits
- ✓ Successful regulatory engagement

## Strong Investment Opportunities

- ✓ Carbon capture plant
- ✓ EOR project participation



# Regulatory

## Highlights

- First of a kind project
- Positive outreach feedback
- Four major applications in 2020

Key Stakeholder	Regulatory/Permitting Area
County of Kern	<ul style="list-style-type: none"><li>• Conditional Use Permit (CUP) for Carbon Capture and CO<sub>2</sub> sequestration;</li><li>• Well/equipment surface use permitting</li><li>• California Environmental Quality Act (CEQA) lead</li></ul>
CalGEM / CA Water Board	<ul style="list-style-type: none"><li>• Underground Injection Control (UIC) permitting</li><li>• Well construction and workover permitting</li></ul>
San Joaquin Valley APCD	<ul style="list-style-type: none"><li>• Air permitting for plants, equipment, pipelines</li><li>• Emission Reduction Credits (ERCs)</li></ul>
CARB	<ul style="list-style-type: none"><li>• Low Carbon Fuel Standards (LCFS) credits and CCS protocols for permanence and quantification</li><li>• California Cap and Trade program management</li></ul>
CEC/CPUC	<ul style="list-style-type: none"><li>• Power Plant Permit</li><li>• Clean Power Purchase Agreement (PPA)</li></ul>
EPA/IRS	<ul style="list-style-type: none"><li>• Class VI (sequestration) injection well permitting</li><li>• 45Q Carbon Credits and CCS protocol</li></ul>